# Understanding Arrays in Java

## 1. Introduction

In Java, an array is a collection of elements of the same type, stored in contiguous memory locations. Arrays are used to store multiple values in a single variable, which makes it easier to manage and manipulate data.

## 2. Characteristics of Arrays

1. Fixed Size: Once an array is created, its size cannot be changed.

2. Indexed: Array elements are accessed using their index, which starts at 0.

3. Homogeneous: All elements in an array must be of the same data type (e.g., int, String, float, etc.).

## 3. Declaring and Initializing Arrays

a) Declaration

Example: int[] numbers; // Declares an array of integers

b) Initialization

1. Using the new keyword: int[] numbers = new int[5]; // Creates an array of size 5

2. With values directly: int[] numbers = {1, 2, 3, 4, 5};

3. Separate declaration and initialization: int[] numbers; numbers = new int[]{1, 2, 3, 4, 5};

## 4. Accessing Array Elements

Array elements are accessed using their index. Example: int[] numbers = {10, 20, 30, 40, 50}; System.out.println(numbers[0]); // Outputs 10

## 5. Looping Through an Array

a) Using a for Loop

Example: for (int i = 0; i < numbers.length; i++) { System.out.println(numbers[i]); }

b) Using a for-each Loop

Example: for (int num : numbers) { System.out.println(num); }

## 6. Common Operations

a) Finding the Length of an Array: int length = numbers.length;

b) Modifying Elements: numbers[1] = 25; // Changes the second element to 25

c) Copying Arrays: int[] copy = original.clone();

## 7. Types of Arrays

a) 1D Arrays: A single row of elements.

Example: int[] arr = {1, 2, 3};

b) 2D Arrays: Arrays with rows and columns (like a table).

Example: int[][] matrix = { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} }; System.out.println(matrix[1][2]); // Outputs 6

c) Jagged Arrays: Arrays with rows of different lengths.

Example: int[][] jaggedArray = { {1, 2, 3}, {4, 5}, {6, 7, 8, 9} };

## 8. Example Programs

### Example 1: Calculate the Sum of All Elements

public class ArraySum {  
 public static void main(String[] args) {  
 int[] numbers = {10, 20, 30, 40, 50};  
 int sum = 0;  
 for (int num : numbers) {  
 sum += num;  
 }  
 System.out.println("The sum is: " + sum);  
 }  
}

### Example 2: Find the Largest Element in an Array

public class LargestElement {  
 public static void main(String[] args) {  
 int[] numbers = {10, 20, 30, 40, 50};  
 int max = numbers[0];  
 for (int num : numbers) {  
 if (num > max) {  
 max = num;  
 }  
 }  
 System.out.println("The largest element is: " + max);  
 }  
}

### Example 3: Reverse an Array

public class ReverseArray {  
 public static void main(String[] args) {  
 int[] numbers = {10, 20, 30, 40, 50};  
 System.out.print("Reversed Array: ");  
 for (int i = numbers.length - 1; i >= 0; i--) {  
 System.out.print(numbers[i] + " ");  
 }  
 }  
}